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A NEW SPECIES, *LITOMOSOIDES ODILAE* N. SP. (NEMATODA: ONCHOCERCIDAE) FROM *OLIGORYZOMYS NIGRIPES* (RODENTIA: MURIDAE) IN THE RAINFOREST OF MISIONES, ARGENTINA

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ABSTRACT: A new species of *Litomosoides* was collected from the abdominal cavity of *Oligoryzomys nigripes* (Rodentia: Muridae) in a semideciduous secondary rainforest of Misiones, Argentina. *Litomosoides odilae* n. sp. belongs to the *carinii* group and is characterized by the amphids displaced dorsally; buccal capsule with an anterior segment transparent and an annular asymmetrical thickening; esophagus divided, with the posterior glandular portion slightly wider than the muscular; male cloacal aperture strongly protruded; and microfilaria sheathed with an attenuated tail. The morphology of the new species, which is similar to that of *L. petteri*, a parasite of marsupials in Brazil, suggests that host-switching events may have occurred in the diversification of this genus.

Species of *Litomosoides* Chandler, 1931 (Nematoda: Onchocercidae) occurs in the thoracic and abdominal cavities of bats, marsupials, and various groups of rodents from the southern Nearctic and Neotropical regions. Since Mazza (1928) described *Litomosoides patersoni* in *Holochilus vulpinus* Brandt (Rodentia: Muridae), there have been no studies of *Litomosoides* spp. in Argentina until recent parasitological studies by Notarnicola et al. (2000, 2002). These authors described 3 new species in muroid rodents from Buenos Aires and Misiones provinces. Two of these species belong to the *sigmodontis* group, 1 is a parasite of *Oxymycterus rufus* Fischer and the other of *O. misionalis* Sandborn (Rodentia: Muridae). The third species belongs to the *carinii* group and occurs in *Oligoryzomys delticola* Thomas (Rodentia: Muridae) (Notarnicola et al., 2000, 2002).

Following additional research on filarioids in the private reserve UNLP del Valle del arroyo Cuñá-Pirú (Misiones province, Argentina), nematodes from the body cavity of *Oligoryzomys nigripes* Olfers (Rodentia: Muridae) were collected and a new species of *Litomosoides* described.

MATERIALS AND METHODS

In July 1999 and March and September 2000, 13 specimens of *Oligoryzomys nigripes* were captured near the Cuñá-Pirú stream. The area is a private reserve located in the Departments of Cainguás and Libertador General San Martín (Misiones, Argentina). According to Cabrera and Willink (1973), the reserve is placed in the Paranaense biogeographical province. The landscape is a semideciduous secondary forest with small patches of grassland. *Oligoryzomys nigripes* is a small nocturnal rodent, which inhabits rainforests and secondary forest growth. It is distributed in eastern Brazil, Paraguay, and eastern Argentina (from Formosa to Buenos Aires provinces) (Redford and Eisemberg, 1992).

The rodents were trapped alive in Kuns-Massoia traps baited with peanut butter, bovine fat, and cotton, killed with ether, and the viscera examined in the field. Adult filarioids were recovered from the thoracic and abdominal cavities of the rodents. They were fixed in 10% formalin, preserved in 70% ethanol, and cleared in lactophenol for light microscopy studies. An apical view of the head and a cross section of the female at the level of the vulva were prepared. For the orientation in lateral and median views of the worms, the lateral cuticular internal ridge, which reaches the anterior extremity, was used. In apical view, the dorsal edge is recognized by the Y-shaped section of the esophageal lumen. Microfilariae were dissected from the uteri of fixed females. Illustrations were made with the aid of a drawing tube. Measurements are presented in the following order: holotype, 3 male paratypes each separated by semicolons, allotype, and female paratypes. If more than 3 paratypes were examined, mean values and standard deviations are presented with ranges in parentheses. Measurements are given in micrometers unless otherwise stated.

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DESCRIPTION

Litomosoides odilae n. sp.

(Fig. 1A–H, 2A–H)

General description (based on 4 males and 12 females): Onchocercidae; Onchocercinae; *Litomosoides* Chandler, 1931. Males about one-fourth to one-third length of females. Cephalic extremity attenuated. Mouth small. Amphids displaced dorsally. Four externo-labial papillae forming rectangle; 2 ventral labial papillae close to one another (Fig. 2B), 2 cephalic papillae, 1 dorsal to right amphid, other ventral to left amphid. Buccal cavity tubular, slightly wider at posterior end. Buccal capsule with anterior segment transparent, posterior parts strongly cuticularized; annular thickening at midlength, asymmetrical in lateral view, with edges pointed backwards. Esophagus divided, with glandular portion slightly wider than muscular portion. Female tail attenuated. Male cloacal aperture strongly protruded. Phasmids conspicuous in both sexes.

Male: Posterior region coiled through 4 loops. Left spicule with blade shorter than handle; blade with cuticularized axis. Right spicule heavily cuticularized, dorsal heel with terminal cap. Cloacal aperture strongly protruded, with 4 pairs of conspicuous postcloacal papillae symmetrically placed. Area rugosa beginning anterior to cloaca composed of transverse ridges of small longitudinal crests, generally extending through the coiled region.

Holotype: Length 17.42 mm; width 141; buccal capsule 20 long, external diameter 7.5; nerve ring 243 from apex; esophagus 435 long; tail 145 long; left spicule 245 long, with handle 140 long; right spicule 110 long. Area rugosa 2,040 long, beginning at 3,060 from tip of tail, extending to 1,020; crests about 1–2 long, distance between 2 consecutive ridges 2–4. Paratypes (n = 3): length 18.62; 15.36; 15.12 mm; width 159; 156; 149; buccal capsule 22; 20; 18 long, maximum diameter 7; 7; 8; nerve ring 693; 300; 293 from apex; esophagus 750; 456; 613 long; tail 104; 120; 138 long; left spicule 228; 230; 260 long, handle 130; 160; 155 long; right spicule 104; 120; 115 long; area rugosa 1,590; 1,700; 1,350 long, beginning 2,445; 2,800; 1,800, extending to 855; 600; 450 from tip of tail.

Female: Anterior region robust. Vulva posterior to esophago-intestinal junction; vagina globular. Ovijector coiled. Tail slightly curved ventrally, with parallel or divergent phasmids. Lateral chords prominent in cross section near the level of the vulva (Fig. 2E).

Allotype: Length 60.36 mm, width 264; buccal capsule 21 long, external diameter 8; nerve ring 300 from apex; esophagus 700 long; vulva 1,350 from apex; tail 410 long. Paratypes (n = 11): length 63.46 ± 9 (54–78); width 286 ± 29.6 (240–325); buccal capsule 21 ± 1.9 (18–24) long, external diameter 8.6 ± 0.5 (8–9); nerve ring 315 ± 54 (246–402) from apex; esophagus 608 ± 32.6 (540–650) long; vulva

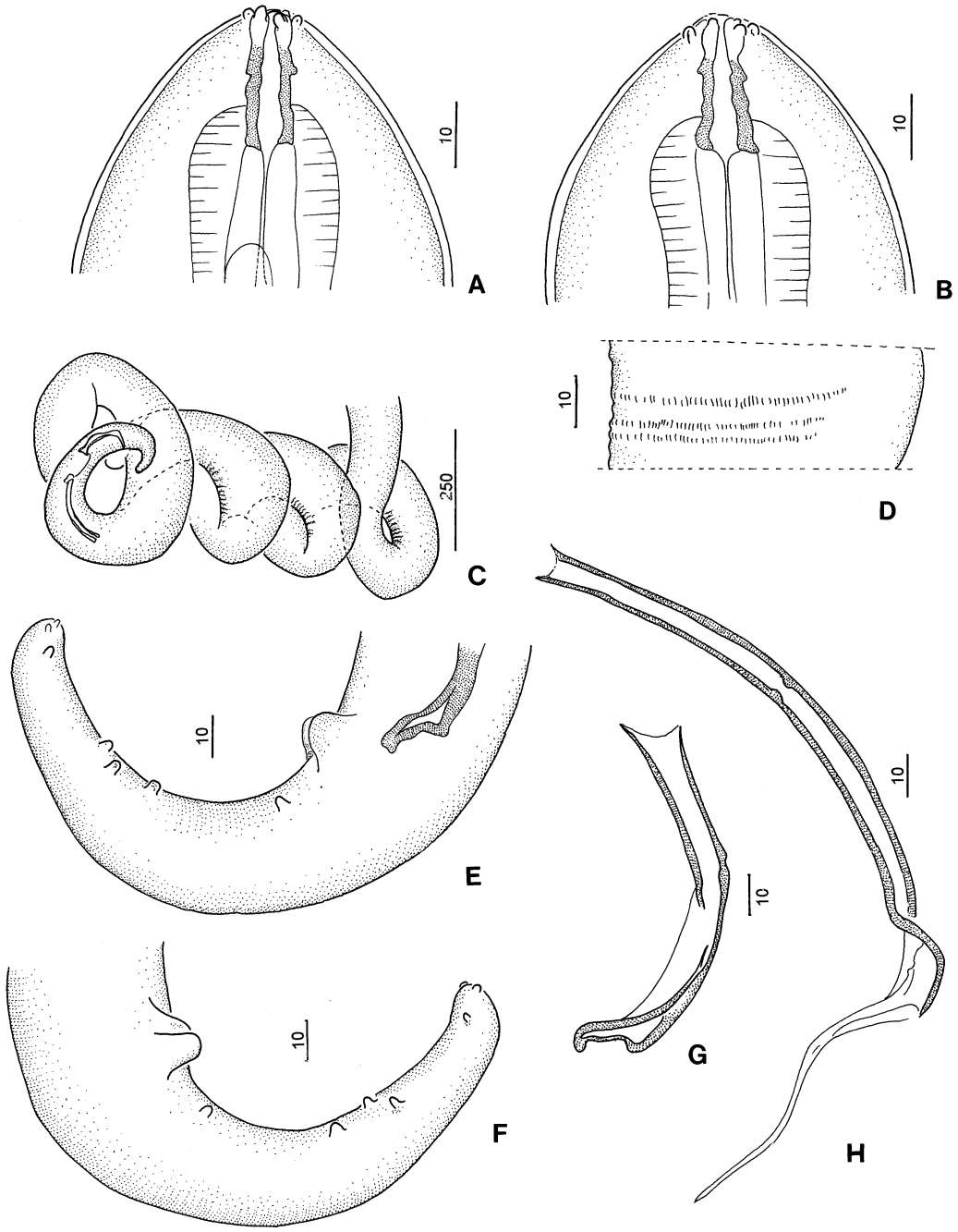

FIGURE 1. *Litomosoides odilae* n. sp. Male holotype. (**A–B**) Buccal capsule, lateral and median views. (**C**) Posterior region. (**D**) Area rugosa at midlength. (**E–F**) Male paratype tail, left and right views. (**G**) Paratype male, right spicule. (**H**) Paratype male, left spicule.

1,190 ± 179.8 (880–1,500) from apex; tail 548 ± 162.9 (370–800) long.

Microfilariae: Body fusiform, sheathed, with a salient cephalic hook. Tail attenuated; thin caudal extremity without nuclei. Measurements based on uterine microfilariae from 2 different females (n = 12): 97 ± 7 (90–112) μm long, 4.7 ± 0.5 (4–5) μm wide.

Taxonomic summary

Type host: Oligoryzomys nigripes Olfers (Rodentia: Muridae) male. Deposited at the Museo de La Plata, Argentina, Mammal Collection number 5.VII.02.1. Other host specimens: *Oligoryzomys nigripes*, male no. 5.VII.02.15, male no. 5.VII.02.16.

Site of infection: Mainly abdominal cavity, 1 female was recovered from the thoracic cavity.

Type locality: Private reserve UNLP del Valle del arroyo Cuñá-Pirú (27°05′15″S, 54°57′09″W), Misiones province, Argentina.

Specimens deposited: Holotype (male), allotype (female), 4 paratypes at the Museo de La Plata, Argentina, Helminthological Collections number 5017, 5018, and 5019, respectively.

Prevalence and intensity: Three out of thirteen hosts parasitized; 13 worms (4 males and 8 females in the abdominal cavity and 1 female in the thoracic cavity) from the type host; 3 females in the second host, and 1 female in the third host.

Etymology: The specific name is given in recognition of the vast amount of work in the study of filarioids of Odile Bain.

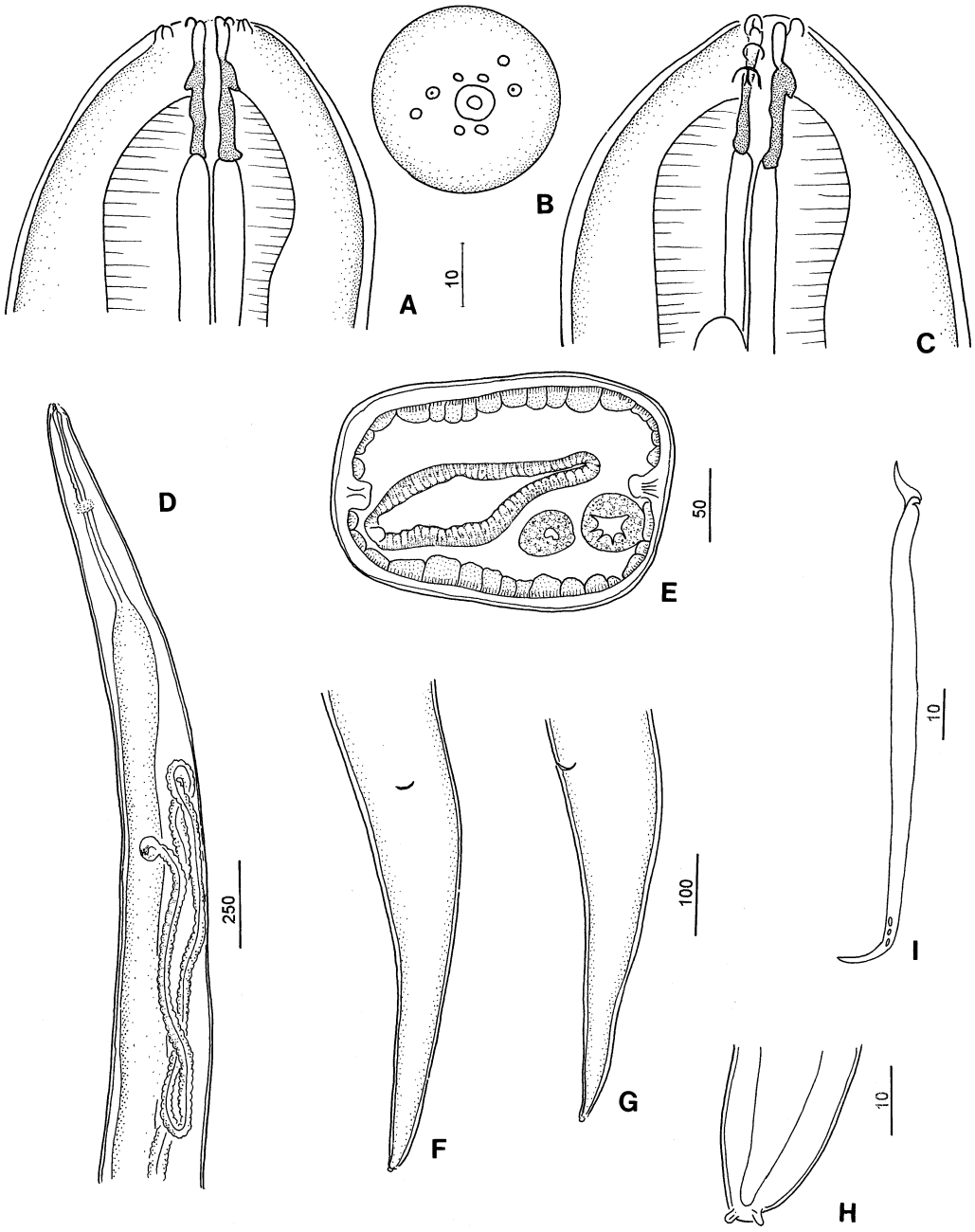

FIGURE 2. *Litomosoides odilae* n. sp. (**A–C**) Female paratype anterior end, median, apical, and lateral views. (**D**) Anterior region of female allotype, ventral view. (**E**) Cross section at the level of the vulva. (**F–G**) Tail, ventral and lateral views. (**H**) Distal end of female tail. (**I**) Uterine microfilaria.

DIAGNOSIS

Litomosoides odilae n. sp. belongs to the *carinii* group as described by Bain et al. (1989): right spicule cuticularized until its distal extremity and with a terminal cap; left spicule with the blade shorter than the handle, without large membranous anterior alae.

In bats the following species differ from *L. odilae* n. sp.: *L. guiterasi* (Vigueras, 1934), *L. molossi* Esslinger, 1973, and *L. chandleri* Esslinger, 1973 are smaller species, with shorter spicules and microfilariae displaying the last nucleus at the tip of tail (Vigueras, 1934; Esslinger, 1973). Moreover, from the redescriptions by Sandground (1934), Rego (1961), and Esslinger (1973), *L. guiterasi* has a shorter tail in both sexes, a truncated extremity in female worms, and vulva at the level of the esophagus. *Litomosoides molossi* has a shorter buccal capsule, no cloacal papillae in the male, and a thinner microfilaria (mean of 3 vs. 4.7). *Litomosoides chandleri* has vulva at the level of the esophagus, right spicule with a heel closer to the cap, and tail of the microfilaria not attenuated. In addition, the last 2 species mentioned above display lateral papillae in the posterior region of the female (Esslinger, 1973). *Litomosoides brasiliensis* Lins de Almeida, 1936 can be distinguished from *L. odilae*

n. sp. because it is a larger species with a longer tail and 3–4 pairs of cloacal papillae aligned in the median longitudinal ventral line, a right spicule with a strong heel, and a tail of the microfilaria with 2 hindmost nuclei elongated (Diaz-Ungria, 1963).

The 4 species parasitic in bats, which cannot be placed in the *sigmodontis* or *carinii* groups, also differ from *L. odilae* n. sp. *Litomosoides artibei* Esslinger, 1973 has a longer buccal capsule without an annular thickening, a more anterior vulva, and a slender microfilaria with a terminal nucleus. *Litomosoides* sp. of Chitwood, 1938 has a buccal capsule with thin regular walls. The microfilaria of *L. colombiensis* Esslinger, 1973 has a terminal elongate nucleus. Those of *L. caliensis* Esslinger, 1973 are shorter (53–65 vs. 90–112) with a round terminal nucleus, and the tail is not attenuated.

Five species, parasitic in rodents, can also be differentiated from *L. odilae* n. sp. *Litomosoides andersoni* Brant and Gardner, 1997, a parasite of ctenomyids, has a triangular buccal capsule, a right spicule with a complex heel, and reduced cloacal papillae (Brant and Gardner, 1997). *Litomosoides carinii* (Travassos, 1919) from *Sciurus* sp. has a shorter buccal capsule, with a wider buccal cavity and a more attenuated tail (Bain et al., 1989). In muroids, *L. scotti* Forrester and Kinsella, 1973 and *L. silvai* Padilha and Faria, 1977 are distinct from the new species by a more posterior vulva, no differentiated esophagus, and smaller microfilariae (mean of 66 and 73, respectively, vs. 97) (Forrester and Kinsella, 1973; Padilha and Faria, 1977). In addition, *L. scotti* has a smaller buccal capsule with a larger thickening at midlength and protruding amphids, and *L. silvai*, redescribed by Moraes Neto et al. (1996), has a buccal capsule with irregular walls, a constricted female tail extremity, and different arrangement of the cloacal papillae. *Litomosoides odilae* n. sp. is similar to *L. bonaerensis* Notarnicola et al., 2000, from *Oligoryzomys delticola* Thomas, and *L. petteri* Bain et al., 1980, from the marsupial *Marmosa cinerea* Temminck, in displaying a buccal capsule with a transparent anterior segment, an annular thickening pointed backwards, and an esophagus with a differentiated glandular portion. But *L. odilae* n. sp. is different from *L. bonaerensis* because the latter has a more posterior vulva, a lateral chord semicircular, a thickened coiled region in the male, and a smaller right spicule (Notarnicola et al., 2000). *Litomosoides petteri* also differs from the new species because it has the vulva at the level of the esophago-intestinal junction and a complete set of cephalic papillae (Bain et al., 1980). Moreover, *L. bonaerensis* and *L. petteri* display a precloacal papilla, no protruded cloacal aperture, and smaller microfilariae (range of 66–76 and 77–83, respectively, vs. 90–112).

DISCUSSION

The species of the genus *Litomosoides* probably evolved by host-switching events. These nematodes apparently have originated in rodents and then diversified in marsupials and bats. *Litomosoides* spp. belonging to the *carinii* group are considered to be the ancestral condition (Bain and Phillipp, 1991; Brant and Gardner, 2000). *Litomosoides odilae* n. sp. retains ancestral features, such as the *carinii* type of spicules, buccal capsule with a transparent anterior segment, and 4 pairs of cloacal papillae symmetrically placed. The morphology of the new species, which is similar to that of *L. petteri*, a parasite of marsupials, would suggest that host-switching events occurred. Moreover, the species found in marsupials were not basal clades, indicating that these mammals are not the ancestral hosts of *Litomosoides* (Brant and Gardner, 2000).

Litomosoides odilae n. sp. is the second species described from the reserva privada UNLP del Valle del arroyo Cuñá-Pirú, along with *L. anguyai* (*sigmodontis* group) from *Oxymycterus misionalis* (Notarnicola et al., 2002). Again, the two groups of *Litomosoides* spp.: *carinii* and *sigmodontis* are represented in sympatric rodents in the same area, as Forrester and Kinsella (1973) noted from the salt-water marshes in Florida, and Notarnicola et al. (2000) from Rio de la Plata marshland, Buenos Aires province.

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